

Success Factors for Construction Waste Recycling in Developing Countries: A Project Management Perspective



Rahimi A. Rahman, Abdulmalek K. Badraddin, Muzamir Hasan,
and Nor'Aini Yusof

1 **Abstract** Construction industries around the world are generating a large number
2 of wastes that end at landfills every year, and recycling is one of the approaches
3 for minimizing that amount. While various strategies have been adopted in practice,
4 recycling rates of construction projects are still at a low level in numerous countries.
5 Therefore, identifying factors that influence the successful recycling of construction
6 waste is crucial. This study identifies the success factors for recycling construction
7 waste from industry practitioners' perspectives. To achieve this objective, interview
8 data with project managers are analyzed using the thematic analysis. The major find-
9 ings from the analysis are: (1) the success factors relate to both people or process; (2)
10 people-related factors involve having individuals that are highly competent, aware on
11 construction waste recycling, and knowledgeable; (3) process-related factors include
12 having a detailed project planning, adequate education and training programs, clear
13 project scope and design, effective procurement system, and consistent monitoring of
14 the construction waste recycling system; and (4) the criticality of the success factors
15 differs between developing countries. This research adds to the body of knowledge by
16 providing a set of success factors for recycling construction waste, which can assist
17 researchers and practitioners in developing strategies to increase recycling rates of
18 construction projects.

19 **Keywords** Sustainable construction · Construction waste management ·
20 Developing countries · Project managers · Success factors

R. A. Rahman (✉) · A. K. Badraddin · M. Hasan

Faculty of Civil Engineering Technology, Universiti Malaysia Pahang, Lebuhraya Tun Razak,
26300 Kuantan, Pahang, Malaysia
e-mail: arahimrahman@ump.edu.my

R. A. Rahman · M. Hasan
Earth Resources and Sustainability Centre, Universiti Malaysia Pahang, Lebuhraya Tun Razak,
26300 Kuantan, Pahang, Malaysia

N. Yusof
School of Housing, Building, and Planning, Universiti Sains Malaysia, USM, 11800 Pulau,
Pinang, Malaysia

References

- 346 1. Lockrey, S., Verghese, K., Crossin, E., Nguyen, H.: Concrete recycling life cycle flows and
347 performance from construction and demolition waste in Hanoi. *J. Clean. Prod.* **179**, 593–604
348 (2018)
- 349 2. Zhang, C., Hu, M., Dong, L., Xiang, P., Zhang, Q., Wu, J., Shi, S.: Co-benefits of urban
350 concrete recycling on the mitigation of greenhouse gas emissions and land use change: A case
351 in Chongqing metropolis, China. *J. Clean. Prod.* **201**, 481–498 (2018)
- 352 3. de Larrard, F., Colina, H.: Concrete Recycling: Research and Practice (2019)
- 353 4. Jin, R., Chen, Q.: Overview of concrete recycling legislation and practice in the United States.
354 *J. Constr. Eng. Manag.* **145**(4), 05019004 (2019)
- 355 5. Pickin, J., Randell, P.: Australian National Waste Report 2016. Department of the Environment
356 and Energy (2017)
- 357 6. Amemiya, T.: Current state and trend of waste and recycling in Japan. *Int. J. Earth Environ.*
358 *Sci.* (2018)
- 359 7. Mah, C.M., Fujiwara, T., Ho, C.S.: Life cycle assessment and life cycle costing toward eco-
360 efficiency concrete waste management in Malaysia. *J. Clean. Prod.* **172**, 3415–3427 (2018)
- 361 8. Mah, C.M., Fujiwara, T., Ho, C.S.: Concrete waste management decision analysis based on
362 life cycle assessment. *Chem. Eng. Trans.* **56**, 25–30 (2017)
- 363 9. Jin, R., Chen, Q.: Investigation of concrete recycling in the US construction industry. *Procedia*
364 *Eng.* **118**, 894–901 (2015)
- 365 10. Chan, A.P., Darko, A., Ameyaw, E.E., Owusu-Manu, D.G.: Barriers affecting the adoption of
366 green building technologies. *J. Manag. Eng.* **33**(3), 04016057 (2016)
- 367 11. Darko, A., Chan, A.P.C., Ameyaw, E.E., He, B.J., Olanipekun, A.O.: Examining issues
368 influencing green building technologies adoption: the United States green building experts'
369 perspectives. *Energy Build.* **144**, 320–332 (2017)
- 370 12. Silvius, A.G., Kampinga, M., Paniagua, S., Mooi, H.: Considering sustainability in project
371 management decision making: An investigation using Q-methodology. *Int. J. Project Manage.*
372 **35**(6), 1133–1150 (2017)
- 373 13. Zhao, X., Hwang, B.G., Lee, H.N.: Identifying critical leadership styles of project managers
374 for green building projects. *Int. J. Constr. Manag.* **16**(2), 150–160 (2016)
- 375 14. Govindan, K., Muduli, K., Devika, K., Barve, A.: Investigation of the influential strength of
376 factors on adoption of green supply chain management practices: an Indian mining scenario.
377 *Ressour. Conserv. Recycl.* **107**, 185–194 (2016)
- 378 15. Gutierrez, A., Boukrami, E., Lumsden, R.: Technological, organisational and environmental
379 factors influencing managers' decision to adopt cloud computing in the UK. *J. Enterp. Inf.*
380 *Manag.* **28**(6), 788–807 (2015)
- 381 16. Lotfi, S., Eggimann, M., Wagner, E., Mróz, R., Deja, J.: Performance of recycled aggregate
382 concrete based on a new concrete recycling technology. *Constr. Build. Mater.* **95**, 243–256
383 (2015)
- 384 17. Lotfi, S., Rem, P., Deja, J., Mróz, R.: An experimental study on the relation between input
385 variables and output quality of a new concrete recycling process. *Constr. Build. Mater.* **137**,
386 128–140 (2017)
- 387 18. Serres, N., Braymand, S., Feugeas, F.: Environmental evaluation of concrete made from
388 recycled concrete aggregate implementing life cycle assessment. *J. Build. Eng.* **5**, 24–33 (2016)
- 389 19. Everaert, M., Stein, R., Michaux, S., Goovaerts, V., Groffils, C., Delvoie, S., ... Broos, K.:
390 Microwave Radiation as a Pre-treatment for Standard and Innovative Fragmentation Techniques
391 in Concrete Recycling. *Materials* **12**(3), 488 (2019)
- 392 20. Kasai, Y.: Barriers to the reuse of construction by-products and the use of recycled aggre-
393 gate in concrete in Japan. In: Sustainable Construction: Use of Recycled Concrete Aggregate:
394 Proceedings of the International Symposium, pp. 433–444 (1998)
- 395 21. Tam, V.W., Tam, L., Le, K.N.: Cross-cultural comparison of concrete recycling decision-making
396 and implementation in construction industry. *Waste Manage.* **30**(2), 291–297 (2010)

- 397 22. Thompson, J.D., Bashford, H.H.: Concrete recycling and utilization of recycled concrete: an
398 investigation of the barriers and drivers within the Phoenix Metropolitan Area. In: Construction
399 Research Congress 2012: Construction Challenges in a Flat World, pp. 1682–1688 (2012)
- 400 23. Begum, R.A., Siwar, C., Pereira, J.J., Jaafar, A.H.: A benefit–cost analysis on the economic
401 feasibility of construction waste minimisation: the case of Malaysia. *Resour. Conserv. Recycl.* **48**(1),
402 86–98 (2006)
- 403 24. Begum, R.A., Siwar, C., Pereira, J.J., Jaafar, A.H.: Implementation of waste management
404 and minimisation in the construction industry of Malaysia. *Resour. Conserv. Recycl.* **51**(1),
405 190–202 (2007)
- 406 25. Begum, R.A., Siwar, C., Pereira, J.J., Jaafar, A.H.: Attitude and behavioral factors in waste
407 management in the construction industry of Malaysia. *Resour. Conserv. Recycl.* **53**(6), 321–328
408 (2009)
- 409 26. Mah, C.M., Fujiwara, T., Ho, C.S.: Construction and demolition waste generation rates for
410 high-rise buildings in Malaysia. *Waste Manage. Res.* **34**(12), 1224–1230 (2016)
- 411 27. Esa, M.R., Halog, A., Rigamonti, L.: Strategies for minimizing construction and demolition
412 wastes in Malaysia. *Resour. Conserv. Recycl.* **120**, 219–229 (2017)
- 413 28. Wahi, N., Joseph, C., Tawie, R., Ikau, R.: Critical review on construction waste control practices:
414 Legislative and waste management perspective. *Procedia Soc. Behav. Sci.* **224**, 276–283 (2016)
- 415 29. Lee, Z.P., Rahman, R.A., Doh, S.I.: Success factors of design-build public sector projects in
416 Malaysia. In: IOP Conference Series: Materials Science and Engineering, Vol. 712, No. 1,
417 p. 012045 (2020)
- 418 30. Rahman, R.A., Radzi, A.R., Saad, M.S.H., Doh, S.I.: Factors affecting the success of highway
419 construction projects: the case of Malaysia. In: IOP Conference Series: Materials Science and
420 Engineering, Vol. 712, No. 1, p. 012030 (2020)
- 421 31. Braun, V., Clarke, V.: Using thematic analysis in psychology. *Qual. Res. Psychol.* **3**(2), 77–101
422 (2006)
- 423 32. Rahman, R.A., Ayer, S.K.: Prevalent issues in BIM-based construction projects. *Proc. Joint
424 Conf. Comput. Constr.* **1**, 645–652 (2017)
- 425 33. Radzi, A.R., Bokhari, H.R., Rahman, R.A., Ayer, S.K.: Key attributes of change agents for
426 successful technology adoptions in construction companies: a thematic analysis. In: Computing
427 in Civil Engineering 2019: Data, Sensing, and Analytics, pp. 430–437 (2019)
- 428 34. Radzi, A.R., Rahman, R.A., Doh, S.I., Esa, M.: Construction readiness parameters for highway
429 projects. In: IOP Conference Series: Materials Science and Engineering, Vol. 712, No. 1,
430 p. 012029 (2020)
- 431 35. Lu, W., Yuan, H.: Exploring critical success factors for waste management in construction
432 projects of China. *Resour. Conserv. Recycl.* **55**(2), 201–208 (2010)
- 433 36. Omran, A., Eltayed, M.: Determining the critical success factors for waste management in
434 construction projects in Khartoum City, Sudan. *Acta Technica Corviniensis-Bull. Eng.* **9**(3),
435 123 (2016)
- 436 37. Al-Agele, H.K.B., Al-Kaabi, S.A.: Identification of key factors affecting waste management
437 in life cycle of the construction project by using Delphi technique. *J. Eng.* **22**(7), 19–34 (2016)

